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The Journal of Transport showcases groundbreaking scientific and applied research conducted by transport-oriented universities, higher educational institutions, research centers, and institutes both within the Republic of Uzbekistan and globally. Recognized for its academic rigor, the journal is included in the prestigious list of scientific publications endorsed by the decree of the Presidium of the Higher Attestation Commission No. 353/3 dated April 6, 2024. This inclusion signifies its role as a vital repository for publishing primary scientific findings from doctoral dissertations, including Doctor of Philosophy (PhD) and Doctor of Science (DSc) candidates in the technical and economic sciences.

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Articles are published in Uzbek, Russian, and English, ensuring a wide-reaching audience and fostering cross-cultural academic exchange. As a beacon of academic excellence, the "Journal of Transport" continues to serve as a vital conduit for knowledge dissemination, collaboration, and innovation in the transport sector and related fields.

Evaluation of the influence of the catalyst on the quantity of exhaust gases

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Abstract: It has been proven in many scientific studies that the role of the catalytic converter in reducing the harmful gases emitted by cars is incomparable. Today, in many developed countries, practical results are being achieved to increase the indicators of environmental pollution of automobile transport. In this article, the function of the catalyst contributing to the chemical reaction in reducing the amount of harmful gases emitted from the passenger car was evaluated, and calculations were made through experiments. A passenger car equipped with a gasoline internal combustion engine was used. It was 1.5 liters in volume, and the car was studied in the idling mode. It was studied that it had a significant effect on the amount of CO, CH, NOx and CO2 gases. Methods of calculation of influence on several parameters of the engine (we, Me, Qy, Qh, Kn, etc.) have been developed. Our scientific research will serve as a basis for developing new software models through future testing and computational methods.

Keywords: electronic control unit (ECU), Scanmatik device, Infracar gas analyzer, air-fuel ratio, air and fuel consumption

Katalizatorning chiqindi gazlar miqdoriga ta’sirini baholash

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Annotatsiya: Avtomobillardan chiqayotgan zararli gazlarni kamaytirishda katalitik-neytralizatorning ro’li beqiyos ekanligi ko’plab ilmiy tadqiqotlarda isbotlangan. Bugungi kunda ko’plab rivojlangan mamlakatlarda, avtomobil transportini ekologik bezararlik ko’rsatkichlarini oshirishga doir amaliy natijalarga erishib kelmoqda. Ushbu maqolada ham yengil avtomobildan chiqayotgan zararli gazlar miqdorini kamaytirishda, kimyoviy reaksiya orqali o’z xissasini qo’shgan katalizatorning vazifasi baholangan bo’lib, eksperimentlar orqali hisob ishlari olib borilgan. Benzinli ichki yonuv dvigateli bilan jihozlangan yengil avtomobil qo’llanilgan. 1.5 litrajli hajmda bo’lib, avtomobil salt ishlash rejimida tadqiqot qilingan. CO, CH, NOx va CO2 gazlarining miqdoriga sezilarli darajada ta’sir qilganligi tadqiqot qilingan. Dvigatelning bir nechta ko’rsatkichlariga (we, Me, Qy, Qh, Kн va boshqalar) ta’siri hisob uslublari ishlab chiqilgan. Olib borilgan ilmiy tadqiqotlarimiz, kelajakdagi sinov va hisob uslublari orqali yangi dastur modellarini ishlab chiqishga asos sifatida xizmat qiladi.

Kalit so‘zlar: elektron boshqaruv blogi(EBB), Scanmatik qurilmasi, Infrakar gazanalizatori, havo-yonilg’i nisbati, havo va yonilg’i sarfi

1. Kirish

Transport vositalarini ekologik ko’rsatkichlarini baxolashda ko’plab sinov va xisob uslublari ishlab chiqilgan. Bugungi kunga qadar davom etib kelmoqda. Sinov uslublarining bir qancha turlari mavjud bo’lib, hisob uslublari bilan ekologik baholash uslubi keng ommalashmoqda. Hisob uslublari ko’plab omillarga bog’liq, dvigatel parametrlarini takomillashishi, yonilg’i turini qo’llanilishi, atrof-muhitning ta’siri kabilar. Hisob uslublari sinov uslublariga nisbatan bir qancha yengilliklar beradi, aloxida laboratoriya sharoiti, maxsus jihozlar, belgilangan vaqt meyorlari, mutaxassislar jamoasi. Har bir hisob uslubi ma’lum qonuniyatga asoslanib, sinov uslublaridan foydalangan ma’lum dastur ishlab chiqiladi. Bu dasturga kerakli parametrlar kiritish orqali hisob uslubi yoziladi hamda tadqiqot ishlari olib boriladi. Biz ham kelajakdagi hisob dasturimizga kiritiladi parametrlarni tadqiq qilmoqdamiz. Bir qancha sinov va hisob uslublari tahlili oqrali o’zimizning hisob uslubimizga asos solish asosiy maqsadlarimizdan biridir.

Adabiyot tahlili. Transport vositalarining chiqindi gazlari miqdor bo’yicha ko’plab soha mutaxassislar ilmiy tadqiqotlar olib borishgan. Maxsus dasturlardan foydalangan holda chorraxadagi chiqindi gazlarni hisoblash[1] ishlari olib borilgan. Avtomobilning xarakat jarayonidagi dvigatelning asosiy paramertlari hisobi [2, 3, 4] dan foydalanamiz, sababi chiqindi gazlar miqdori, turi, hajmi ko’rsatkichlar bevosita dvigatelga bog’liq. Chiqindi gazlarni hisob uslublari bilan baholash[5], [6] hamda katalizator ishini baholash [7] [8] kabi ko’plab ilmiy tadqiqotlar soha mutaxassislari tomonidan olib borilgan.

2. Tadqiqot metodologiyasi

Avtomobilni chiqindi gazlari miqdorini tadqiqot qilishda dastlab sinov hamda hisob uslublarini qo’lladik. Sinovdan

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olingan natijalar, matematik taxlil qilindi hamda hisob uslulari ishlab chiqildi.

Benzin bilan kislorod reaksiyaga kirishishi natijasida CO_2 va H_2O molekulalari xosil bo‘ladi.

$$C_xH_y + O_2 = CO_2 + H_2O \quad (1)$$

Bu tenglamada kimyoviy reaksiya to‘liq amalga oshirilganda, miqdor jixatdan tenglashadi. 1 gr benzin to‘liq reaksiyaga kirib yonishi uchun deyarli 3 gr kislorod kerak bo‘lsa, 3 gr CO_2 va 1 gr H_2O gazlari ajralib chiqadi (benzin markasiga ko‘ra).

Masalan,

$$C_{8.26}H_{15.5} + 12.135 * O_2 = 8.26 * CO_2 + 7.75 * H_2O$$

114.62 gr (benzin) + 388.32 gr (kislorod) = 363.44 gr (CO_2) +139.5 gr (H_2O)

Тенгламани хар иккила томонини 114.62 га бўламиз 1 gr (benzin) + 3.38 gr (kislorod) = 3.17 gr (CO_2) +1.22 gr (H_2O)

Tenglamadan ko‘rinib turibdiki, 1 gr benzin to‘liq yonishi uchun 3.38 gr O_2 kerak bo‘ladi, undan 3.17 gr CO_2 va 1.22 gr H_2O ajralib chiqadi. Benzinning massasi H_2O ga, O_2 ning massasi CO_2 ga yaqin ekanligi isbotlandi. CO_2 ning massasi O_2 massasining 93.78 % tashkil etadi.

Keyingi markadagi benzinni xisoblab chiqamiz

$$C_{7.76}H_{13.1} + 11.035 * O_2 = 7.76 * CO_2 + 6.55 * H_2O \quad (2)$$

106.22 gr (benzin) + 353.12 gr (kislorod) = 341.44 gr (CO_2) +117.9 gr (H_2O)

Tenglamani xar ikkila tomonini 106.22 ga bo‘lamiz

1 gr (benzin) + 3.32 gr (kislorod) = 3.21 gr (CO_2) +1.11 gr (H_2O)

Bu tenglamada, 1 gr benzin to‘liq yonishi uchun 3.32 gr O_2 kerak bo‘ldi, undan 3.21 gr CO_2 va 1.11 gr H_2O ajralib chiqdi. CO_2 ning massasi O_2 massasining 96.68 % tashkil etdi.

Oktanning xam tengmasini ko‘rib chiqamiz

$$C_8H_{18} + 12.5 * O_2 = 8 * CO_2 + 9 * H_2O \quad (3)$$

114 gr (benzin) + 400 gr (kislorod) = 352 gr (CO_2) + 162 gr (H_2O)

Tenglamani xar ikkila tomonini 114 ga bo‘lamiz

1 gr (benzin) + 3.51 gr (kislorod) = 3.09 gr (CO_2) +1.42 gr (H_2O)

Demak, 1 gr benzin to‘liq yonishi uchun 3.51 gr O_2 kerak bo‘ldi, undan 3.09 gr CO_2 va 1.42 gr H_2O ajralib chiqdi. CO_2 ning massasi O_2 massasining 88.03 % tashkil etdi.

3. Tahlil va natijalar

Engil avtomobillarning dvigatellarida bunday kimyoviy reaksiya qanday amalga oshirilishi xamda massa jixatidan qiymatlarini qo‘rib chiqamiz.

Tajribada engil avtomobilning chiqindi gazlari miqdori ikki usulda o‘lchandi. Katalitik-neytralizator ko‘llanilgan xolda xamda ko‘llanilmagan xolda o‘tkazildi. Avtomobil salt ishlash rejimida, maxsus laboratoriya sharoitida sinov ishlari olib borildi. Skanmatik diagnostik kurilmasi dvigatel parametrlarini, Infrakar gazanalizator chiqindi gazlar miqdorini o‘lchab beradi. 1 – jadvalda katalizator ko‘llanilishi xamda qo‘llanilmagan xoldagi sinov natijalari berilgan.

1-jadval

Katalizator qo‘llanilishi xamda qo‘llanilmagan xoldagi sinov natijalari

T/r	Katalizatorning mavjudligi	EBB dagi ko’rsatkichlar				Hisoblangan parametrlar			
		Dvigatel tirsakli val aylanishlari soni, ayl/min	Injector sepish vaqti, ms	Havo sarfi, g/s	Dvigatel burovchi momenti, Nm	Yonilg’i sarfi, g/s	λ(EBB)	Kn	Umumiy gazlar massasi, gr
1	Бор	800	1,562	1,996	1,4	0,136	0,9999	0,184	2,13
	Йўқ		1,46	1,82	1	0,127	0,973	0,168	1,94
2	Бор	1000	1,302	2,528	1,2	0,141	1,2155	0,183	2,66
	Йўқ		1,32	2,39	1	0,156	1,0389	0,161	2,54
3	Бор	2000	1,3	4,258	2,4	0,283	1,0252	0,157	4,54
	Йўқ		1,38	4,64	3	0,323	0,9758	0,159	4,96
4	Бор	3000	1,428	7,11	4,4	0,466	1,039	0,174	7,57
	Йўқ		1,35	6,5	3	0,431	1,0252	0,163	6,93

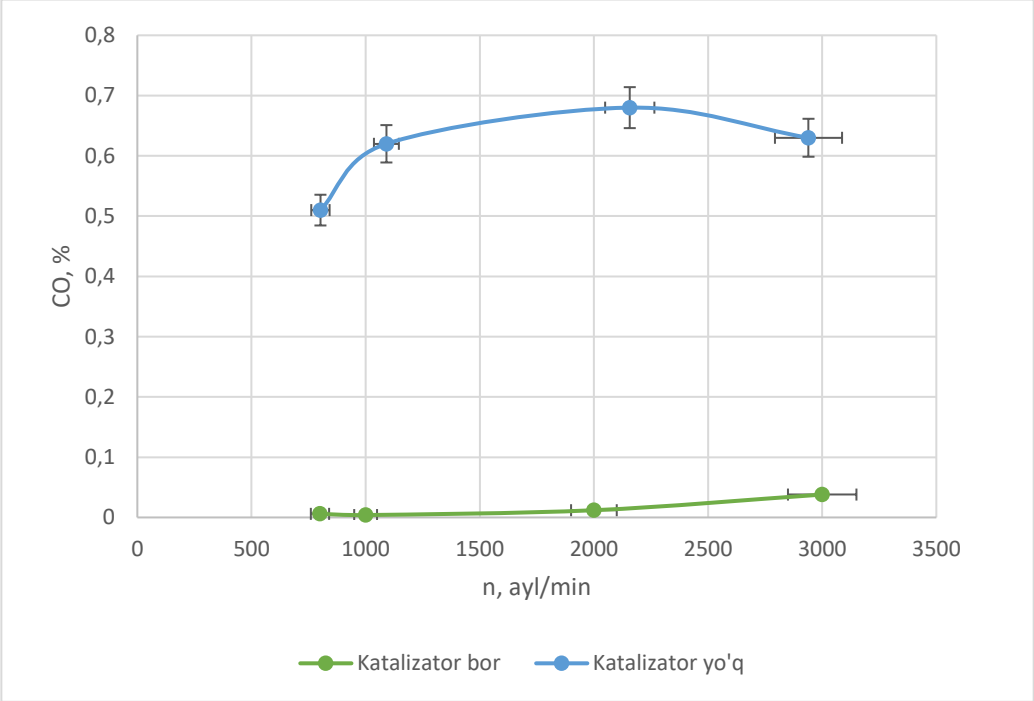
Jadvalning yashil ustuni katalizator ko‘llanilgan xoldagi, sariq ustuni katalizator qo‘llanilmagan xoldagi olingan parametrlar. Chiqindi gazlarning umumiy massasi katalizator yuk bo‘lganda ishlab chiqiriladi, lekin zararlilik darajasi yuqori bo‘ladi, buni 2 – jadval misolida ko‘rish mumkin. Dvigatel tirsakli vali aylanishlari soni 2 xil vaziyat uchun bir xil qiymatda o‘lchandi. Mavjud standarlarga asosan salt ishlash rejimida minimal 800 ayl/min, maksimal 3000 ayl/min gacha olinadi.

2-jadval

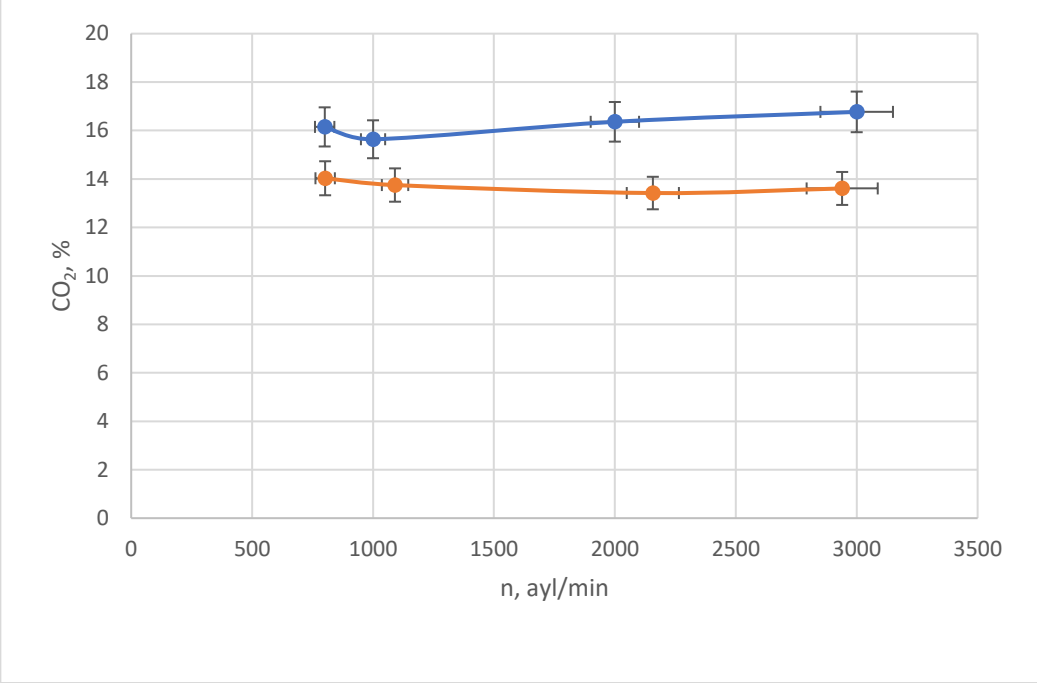
Katalizator qo‘llanilishi xamda qo‘llanilmagan xoldagi gazanalizator ko’rsatkichlari

T/r	Dvigatel tirsakli val aylanishlari soni, ayl/min	Katalizatorning mavjudligi	Gazanalizator ko’rsatkichi				
			CO, %	CH, mln-1	CO_2, %	NOx, mln-1	λ
1	800	Бор	0,006	16,2	16,15	0,062	1,0078
		Йўқ	0,51	270	14,03	1,1	1,03
2	1000	Бор	0,004	25,8	15,64	0,028	1,0058
		Йўқ	0,62	197	13,75	0,94	1,02
3	2000	Бор	0,012	0	16,36	0,07	1,0084
		Йўқ	0,68	146	13,42	0,87	1,02
4	3000	Бор	0,038	0	16,77	0,052	1,0068
		Йўқ	0,63	119	13,61	0,67	1,01

Quyidagi 1-2-3-4- rasmlar orqali katalizatorning axamiyatini ko‘rish mumkin. Chiqindi gazlar tarkibiga xamda miqdoriga sezilarli darajada ta'sir ko‘rsatishi sinov orqali isbotlandi.



1 – rasm. CO va dvigatel tirsakli vali aylanishlari soni bog‘liqligi



2 – rasm. CO_2 va dvigatel tirsakli vali aylanishlari soni bog‘liqligi.

Katalizator bor **Katalizator yo’q**

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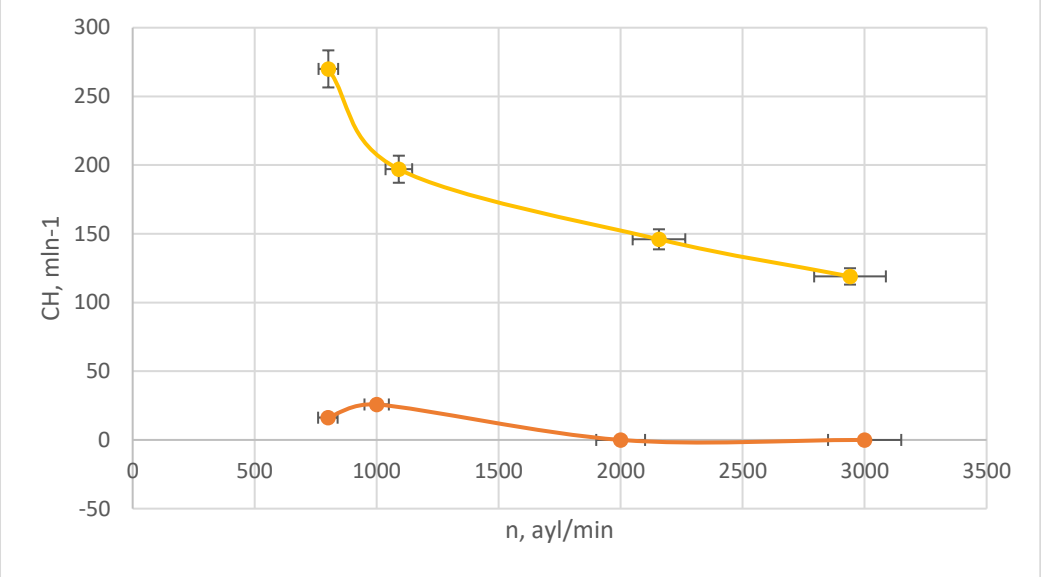
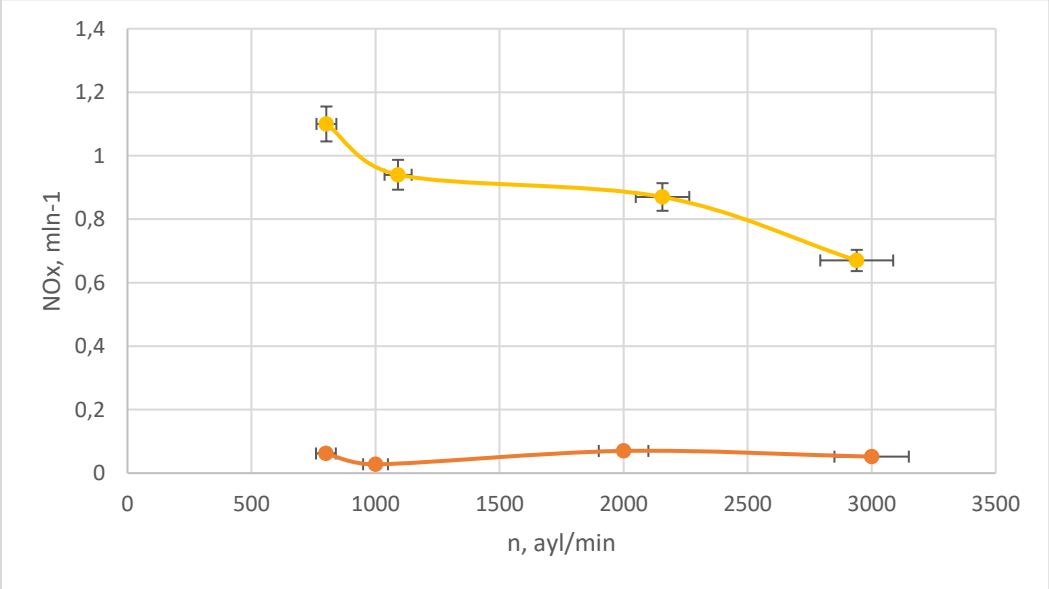


3 – rasm. CH va dvigatel tirsakli vali aylanishlari soni bog‘liqligi

Katalizator bor **Katalizator yo’q**



4 – rasm. NOx va dvigatel tirsakli vali aylanishlari soni bog‘liqligi

Katalizator bor **Katalizator yo’q**

Sarflangan xavo miqdori orqali O2 ni massasini aniqlab olamiz, xavo tarkibida 21% O2 borligini inobatga olsak quyidagi jadval ko‘rinishida bo‘ladi. (1) tenglamaga muvofik SO2 ning massasini xam xisoblaymiz.

3-jadval

Katalizator qo‘llanilishi xamda qo‘llanilmagan xoldagi gazanalizator ko’rsatkichlari

T/r	Dvigatel tirsakli val aylanishlari soni, ayl/min	Katalizatorning mavjudligi	21% O_2	CO_2, %	A* CO_2 g/s	B* CO_2 g/s	Δ
1	800	Bor	0,41916	16,15	0,344284		
		Yo’q	0,3822	14,03	0,273198	0,314479	82,28133
2	1000	Bor	0,53088	15,64	0,417507		
		Yo’q	0,5019	13,75	0,350143	0,398272	79,35276
3	2000	Bor	0,89418	16,36	0,742831		
		Yo’q	0,9744	13,42	0,666097	0,812023	83,33566
4	3000	Bor	1,4931	16,77	1,270416		
		Yo’q	1,365	13,61	0,94335	1,162379	85,15595

A*CO_2 ning belgilangan % dagi massasi
B*Katalizator bor, CO_2 ning ko‘rsatkichi 16 % atrofida bo‘lgandagi massasi
Δ – xatolik darajasi , O_2 ga nisbatan xisoblaganda

(1) Tenglama orqali kimyoviy reaksiya natijasida CO_2 ning massasi O_2 massasining 93.78 % tashkil etsa, katalizator qo‘llanilishi natijasida CO_2 massasini (dvigatel tirsakli vali, yuklamasi inobatga olinadi) 85.155 % ga yakinlashtirib beradi. Agarda CO_2 13.61 % emas, 16.77 % ni tashkil etsa xamda qolgan parametrlar o‘zgarmagan xolda bo‘lsa. O_2 miqdori 1.365 gr, CO_2 1.16 gr, oraliq farq 85.155 % ekanligi kelib chiqadi. Bashorat qilingan qiymat bo‘ladi.

4. Xulosa va takliflar

Yuqoridagi (1), (2) va (3) tenglamalardan ko‘rinib turibdiki, CO_2 ning massasi benzin tarkibidagi C va H ning miqdori bog‘liq. O_2 ning miqdori xam mutanosib ravishda oshib boradi. Kislorod oshishi xavoning oshishiga sabab bo‘ladi, bu esa yana ko‘shimcha benzin sarfiga olib keladi.

Olib borilgan tadqiqotdan shunday xulosa qilish mumkinki, avtomobillarga qo‘llanilgan katalizatorlar xamisha yonilg‘i va xavo o‘rtasida mutanosiblikni ushlab turishga intiladi. CO_2 massasi misolida ko‘rib chiqdik, kimyoviy reaksiya orqali CO_2 ning qiymatini O_2 qiymatiga yaqinlashtirib beradi. 3 xil markadagi benzinning CO_2 massalarini O_2 ga nisbatan taqqoslab chiqdik. Oktan ayrim manbalar Ai-92 benzin deb yuritiladi. Biz xam tajriba-sinov ishlarini tijorat benzini Ai-92 dan foydalandik. Kimyoviy reaksiya natijasida CO_2 ning massasi O_2 massasining 88.03 % tashkil etsa, bashorat qilingan qiymatlarning % ko‘rsatkichlari 82,28-79.35-83.33-85.15 bo‘ladi. Katalizatorning axamiyati shundaki, CO_2 massasini kimyoviy reaksiyadagi massaga yakin qilib berishga intiladi.

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